

**WHAT IS CLAIMED IS:**

- 1 1. A method comprising the steps of:
  - 2 receiving a first quantization value for a first macroblock;
  - 3 determining a second quantization value for the first macroblock based on the first
  - 4 quantization value and a first expected amount of video data in a video buffer.
- 1 2. The method of claim 1, further comprising the step of modifying the first macroblock based on  
the second quantization value.
- 1 3. The method of claim 1, wherein the first quantization value is received from a source of the first  
macroblock.
- 1 4. The method of claim 1, wherein an address location of a video buffer represents the first expected  
amount of data in the video buffer.
- 1 5. The method of claim 1, wherein a buffer delay value indicating when a frame is to be processed  
2 represents the first expected amount of data in the video buffer.
- 1 6. The method of claim 5, wherein the buffer delay value is based on a number of frames stored in a  
2 buffer location of the video buffer.
- 1 7. The method of claim 1, wherein the first expected amount of data is determined based on a  
2 modeling of the video buffer.

1       8. The method of claim 7, wherein the modeling of the video buffer includes determining a fullness  
2           of a video buffer based on a difference between a input rate and a output rate.

1       9. The method of claim 7, wherein modeling of the video buffer includes using a VBV buffer  
2           model.

1       10. The method of claim 1, wherein the step of determining further includes determining the second  
2           quantization value based on a first ratio of a input bit rate to a output bit rate.

1       11. The method of claim 10, wherein the step of determining further includes determining the  
2           second quantization value based on a second ratio of the first ratio to a source bit count.

1       12. The method of claim 10, wherein the step of determining further includes determining the  
2           second quantization value based on a product value of a X scaling value and a Y scaling  
          value, wherein the product value is raised to a power of Z where Z is less than one.

1       13. The method of claim 12, wherein the X scaling value includes a horizontal frame size value and  
2           the Y scaling value includes a vertical frame size value.

1       14. The method of claim 13, wherein Z is .75 +/- 0.1.

1       15. The method of claim 1, wherein the second quantization value includes a ratio value of the first  
2           quantization value to a quantization ratio.

1       16. The method of claim 15, wherein the quantization ratio is based on the first expected amount of  
2           data.

- 1    17. The method of claim 16, wherein:
- 2        the quantization ratio includes a first constant value when the first expected amount of data  
3            is greater than a first indicator;
- 4        the quantization ratio includes a second constant value when the first expected amount of data  
5            is less than the first indicator and greater than a second indicator; and
- 6        the quantization ratio is determined from a non-linear function when the first expected  
7            amount of data is less than the second indicator.
18. The method of claim 17, wherein the first indicator is a buffer fullness value of 75% +/- 1% of a maximum buffer fullness.
19. The method of claim 17, wherein the second indicator is a buffer fullness value of 20% +/- 1% of a maximum buffer fullness.
20. The method of claim 17, wherein the non-linear function includes an equation:

$$R = Q * X^{(Y-W)/Z}$$

3        where R is the quantization ratio, Q is an initial quantization ratio, X is a first constant  
4            value, Y is a second constant, W is a value representing the amount of data, and Z is a  
5            third constant value.

- 1    21. A method comprising the steps of:
- 2        modifying a quantization value for a first macroblock by a first constant value when an  
3                  amount of data stored in a buffer is greater than a first indicator;
- 4        modifying the quantization value for the first macroblock by a second constant value when  
5                  the amount of data stored in the buffer is greater than a second indicator and less than  
6                  the first indicator; and
- 7        modifying the quantization value for the first macroblock by a non-linear value when the  
8                  amount of data stored in the buffer is less than the second indicator.

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- 1 22. A method comprising the steps of:  
2       determining a first quantization value associated with a first macroblock;  
3       modifying the first macroblock using a second quantization value, wherein the second  
4           quantization value is based on a ratio of a first quantization ratio to the first  
5           quantization value, and where the first quantization ratio is based on a first expected  
6           characteristic of a video buffer.
- 1 23. The method of claim 22, wherein the step of determining the first quantization value includes  
2       receiving the first quantization value from a source of the first macroblock.
- 1 24. The method of claim 22, wherein the first expected characteristic of the video buffer includes a  
2       fullness of the video buffer.
- 1 25. The method of claim 22, wherein a buffer delay value indicating when a frame is to be  
2       processed represents the first expected characteristic of the video buffer.
- 1 26. The method of claim 25, wherein the buffer delay value is based on a number of frames stored  
2       in a buffer location.
- 1 27. The method of claim 22, wherein the first expected characteristic is determined based on a  
2       modeling of the video buffer.
- 1 28. The method of claim 27, wherein the modeling of the video buffer includes determining a  
2       fullness of the video buffer based on a difference between an input rate and an output rate.

1    29. The method of claim 27, wherein the modeling of the video buffer includes using a VBV buffer  
2       model.

1    30. The method of claim 22, wherein the quantization ratio is based on a product value of a X  
2       scaling value and a Y scaling value, wherein the product value is raised to a power of Z  
3       where Z is less than one.

1    31. The method of claim 30, wherein the X scaling value includes a horizontal frame scaling value  
2       and the Y scaling value includes a vertical frame scaling value.

1    32. The method of claim 30, wherein Z is .75 +/- 0.1.

1    33. The method of claim 30, wherein:  
2       the quantization ratio includes a first constant value when the first expected characteristic is  
3           greater than a first indicator;  
4       the quantization ratio includes a second constant value when the first expected characteristic  
5           is less than the first indicator and greater than a second buffer indicator; and  
6       the quantization ratio is determined from a non-linear function when the first expected  
7           characteristic is less than the second indicator.

1    34. The method of claim 33, wherein the first indicator is a buffer fullness value of 75% +/- 1% of a  
2       maximum buffer fullness.

1    35. The method of claim 33, wherein the second indicator is a buffer fullness value of 20% +/- 1%  
2       of a maximum buffer fullness.

1 36. The method of claim 33, wherein the non-linear function includes an equation:

$$R = Q * X^{(Y-W)/Z}$$

where R is the quantization ratio, Q is an initial quantization ratio, X is a first constant value, Y is a second constant, W is a value representing the amount of data, and Z is a third constant value.

1 37. A system for rate control comprising:

a monitoring module having an output, said monitoring module to determine a first expected characteristic of a target decoder and to determine a source quantization value for a received source macroblock; and

a rate control module having a first input coupled to the output of said monitoring module to receive the first expected characteristic and the source quantization value and an output, said rate control module to determine a transcoding quantization value for the source macroblock based on the first expected characteristic and the source quantization value.

38. The system of claim 37, further including a quantizer having an input coupled to said rate control module, said quantizer to quantize the source macroblock using the transcoding quantization value.

39. The system of claim 37, further including a ratio generator having an output, said ratio generator to determine a quantization ratio based on the first expected characteristic of the target decoder.

1 40. The system of claim 39, said rate control module further having an input coupled to the output  
2 of said ratio generator to receive the quantization ratio, the rate control module to determine  
3 the transcoding quantization value based on a ratio value of the source quantization value to  
4 the quantization ratio.

1 41. The system of claim 37, wherein said rate control module determines the transcoding  
2 quantization value based on a non-linear function applied to the source quantization value.

1       42. The system of claim 37, wherein the first expected characteristic includes a fullness of a buffer  
2                   associated with the target decoder.

1       43. The system of Claim 42, wherein the fullness of the buffer is obtained from the target decoder.

1       44. The system of Claim 42, wherein the fullness of the buffer is determined from a model of the  
2                   buffer.

1       45. The system of Claim 42, wherein the model includes a VBV buffer model.

1       46. The system of claim 42, wherein said monitoring module uses an address location of the buffer  
2                   to determine the fullness of the buffer.

1       47. The system of claim 37, wherein the first expected characteristic includes a delay value  
2                   associated with a buffer.

1       48. The method of claim 47, wherein the delay value is based on a number of frames stored in an  
2                   the buffer.

1       49. The system of claim 37, wherein said monitoring module models the target decoder to  
2                   determine the first expected characteristic.

1       50. The system of claim 49, wherein said monitoring module models a measurement of a difference  
2                   between a input rate and a output rate.

- 1    51. A computer readable medium, said computer readable medium including instructions to  
2       manipulate a processor to:  
3       receive a first quantization value for a first macroblock;  
4       determine a second quantization value for the first macroblock based on the first  
5       quantization value and a first expected amount of video data in a video buffer.
- 1    52. The computer readable medium of claim 51, wherein said instructions further include  
2       instructions to manipulate said processor to modify the first macroblock based on the second  
3       quantization value.
53. The computer readable medium of claim 51, wherein the first quantization value is received  
from a source of the first macroblock.

- 1 54. The computer readable medium of claim 51, wherein an address location of a video buffer  
2 represents the first expected amount of data in the video buffer.

1 55. The computer readable medium of claim 51, wherein a buffer delay value indicating when a  
2 frame is to be processed represents the first expected amount of data in the video buffer.

1 56. The computer readable medium of claim 55, wherein the buffer delay value is based on a  
2 number of frames stored in a buffer location of the video buffer.

1 57. The computer readable medium of claim 51, wherein the first expected amount of data is  
2 determined based on a modeling of the video buffer.

1 58. The computer readable medium of claim 57, wherein the modeling of the video buffer includes  
2 using a VBV buffer model.

1 59. The computer readable medium of claim 57, wherein the modeling of the video buffer includes  
2 determining a fullness of a video buffer based on a difference between a input rate and a  
3 output rate.

1 60. The computer readable medium of claim 51, wherein said instructions to manipulate said  
2 processor to determine further include instructions to manipulate said processor to determine  
3 the second quantization value based on a first ratio of a input bit rate to a output bit rate.

1 61. The computer readable medium of claim 60, wherein said instructions to manipulate said  
2 processor to determine further include instructions to manipulate said processor to determine  
3 the second quantization value based on a second ratio of the first ratio to a source bit count.

1       62. The computer readable medium of claim 60, wherein said instructions to manipulate said  
2       processor to determine further include instructions to manipulate said processor to determine  
3       the second quantization value based on a product value of a X scaling value and a Y scaling  
4       value, wherein the product value is raised to a power of Z where Z is less than one.

1       63. The computer readable medium of claim 62, wherein the X scaling value includes a horizontal  
2       frame size value and the Y scaling value includes a vertical frame size value.

64. The computer readable medium of claim 63, wherein Z is .75 +/- 0.1.

65. The computer readable medium of claim 51, wherein the second quantization value includes a  
ratio value of the first quantization value to a quantization ratio.

66. The computer readable medium of claim 65, wherein the quantization ratio is based on the first  
expected amount of data.

1       67. The computer readable medium of claim 66, wherein:  
2              the quantization ratio includes a first constant value when the first expected amount of data  
3              is greater than a first indicator;  
4              the quantization ratio includes a second constant value when the first expected amount of  
5              data is less than the first indicator and greater than a second indicator; and  
6              the quantization ratio is determined from a non-linear function when the first expected  
7              amount of data is less than the second indicator.

1       68. The computer readable medium of claim 67, wherein the first indicator is a buffer fullness value  
2       of 75% +/- 1% of a maximum buffer fullness.

1    69. The computer readable medium of claim 67, wherein the second indicator is a buffer fullness  
2        value of 20% +/- 1% of a maximum buffer fullness.

1    70. The computer readable medium of claim 67, wherein the non-linear function includes an  
2        equation:

3                           $R = Q * X^{(Y-W)/Z}$

where R is the quantization ratio, Q is an initial quantization ratio, X is a first constant value, Y is a second constant, W is a value representing the amount of data, and Z is a third constant value.